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Connecting Element for Hollow Sections of Different Cross-Section

The invention relates to a connecting element for insertion into the ends of at least two hollow sections of different cross-section, in particular a middle node for an instrument panel transverse beam in automobile manufacture.

Such connecting elements or middle nodes for hollow sections – possibly of lengths of dish-shaped parts, preferably half-shell shaped parts – in particular hollow sections of rectangular cross-section are known in the form of die-cast or shaped sheet parts. Such transverse beams are also known as cockpit carriers and are usually T-shaped with a hollow section on the driver side of the middle node and, on the other side, another hollow section for the passenger side. A support beam may also be present, resulting in a T-shaped transverse beam.

The known box-shaped middle nodes - with a middle wall and on both sides an integral rib, in each case forming a cross-section suitable for insertion purposes – are made by die-casting or by shape-forming and stamping sheet material; these require relatively high tooling costs and usually require very time-consuming post-production processing. Furthermore, the middle nodes for left-hand-drive and right-hand-drive vehicles have to be produced in specially designed tools.

In view of the above the object of the present invention is to produce a middle node of the kind mentioned at the start involving low tooling costs and, thereby, to reduce the cost of post-production processing. In addition, efforts are made to be able to produce the middle nodes for left-hand-drive and right-hand-drive vehicles using the same tooling.

That objective is achieved by way of the invention in that a push-fit body is shape-formed - by way of extrusion of light weight metal, plastic or another extrudable material - in a frame, whereby the push-fit body is of smaller cross-section than the frame and parts of the frame form parts of the walls of the push-fit body. To that end it has been found favourable for the frame to surround the push-fit body and the latter preferably to be a corner of the frame.

According to a further detail of the invention an integral frame bracket resp. frame hoop may be formed on the outside of one side of the frame, the walls of which frame bracket are aligned with the two parallel neighbouring frame walls. In order to

facilitate the joining of this middle node e.g. to a supporting arm projecting out of a vehicle tunnel, two sleeves for bolts are provided in opposite lying corners of the frame or frame bracket on the frame, said sleeves likewise being formed in the extrusion process.

Frames and push-fit bodies may form a compact extruded part which is delimited by two parallel planes. However, it has been found favourable to allow at least the push-fit body on one side to project out of the frame which penetrates one of the planes. If an integral frame bracket is provided, the frame may project out of one of its sides and the push-fit body from the other side.

In all the result is a clever means of manufacturing middle nodes for the required field of application which meet the set objectives.

Further advantages, features and details of the invention are revealed in the following description of preferred exemplified embodiments and with the aid of the drawing which shows in

Fig. 1: a perspective view of a transverse beam with support-ing arm and so called middle node as stiffening element for a private car;

Fig. 2: an enlarged section from figure 1;

Fig. 3, 4: cross-sections through different versions of the support arm;

Fig. 5: an enlarged perspective view of the middle nodes shown in figures 1 and 2:

Fig. 6, 8, 10: perspective views of three further versions of trans-verse beams with middle nodes;

Fig. 7, 9, 11: enlarged perspective views of the middle nodes shown in figures 6, 8 and 10;

Fig. 12: a perspective view of another middle node;

Fig. 13: an end view of the middle node shown in figure 12;

Fig. 14: a front elevation relating to figures 12 and 13;

Fig. 15, 18, 21: perspective views of three further designs of middle node;

Fig. 16, 19, 22: front elevations of the middle nodes shown in figures 15, 18, and 21;

Fig. 17, 20, 23: end views relating to figures 16, 19 and 22.

A T-shaped transverse beam 10 for installation under the instrument panel of a private car - not shown here – exhibits a middle node 20 as means for connecting a support arm 12, which is vertical when installed, for connection to a support arm 14 - at right angles in figure 1 - for the driver side and a support arm 16 for the passenger side. Such a transverse beam 10 is also known as a cockpit carrier.

The middle node 20 serves the purpose of providing a transition from the driver-side support arm 14, which is in the form of a hollow section and approximately quadratic in cross-section, to the passenger-side support arm 16 which is aligned with the support arm 14. The latter is also a hollow section, the cross-section of which is likewise quadratic and smaller than that of the other support arm 14. In addition, the thickness of the four sheet walls 17 of the longer support arm 16 is less than the thickness of the walls 15 of the support arm 14 for the driver side. Also the middle node 20 should accommodate this transition in wall thickness onto which the support arms 14, 16 are pushed in direction x.

The support arm 12 - serving as support for the vehicle tunnel which is not shown here - features, as shown in figure 3, a narrow, open, rectangular, shell-like cross-section and, as 12_d in figure 4, a double shell-like cross-section and is fitted close to its upper edge 13 with openings 18 for bolts or other connecting elements.

The middle node 20 shown in figures 1, 2 and 5 is in one piece, manufactured by extrusion of a light metal alloy, and exhibits an approximately quadratic push-fit body 22 of height a at the side and breadth b, the outer contour of which corresponds to the inner contour of the narrower support arm 16, with little play; the

faces of its walls 24 are oriented in the direction of displacement or insertion x. The push-fit body 22 is integrated in a likewise quadratic frame 30 of about half the breadth b_1 and about double the height e such that the push-fit body 22 forms one frame corner 31 and two of the strip-shaped sides 32 run into the aligned body walls 24, whereby one of the wall edges 26 – the rear edge in figure 5 – coincides with the edge 34 of the related frame side 32 i.e. the push-fit body 22 projects out of one side of the frame 30 by a distance f; the latter corresponds approximately to the breadth b_1.

Sub a1

Provided on the outside, at the free inner corner 28 of the push-fit body 22, is an integral diagonal strip 36 of breadth b_1 which runs to the above mentioned neighbouring, diagonally opposite corner 31_a of the push-fit body 22 where an intervening sleeve 38 for a bolt is situated. The corners 31, 31_a are rounded. A second sleeve 38 for a bolt is provided in the other corner 31_a, parallel to and opposite the sleeve 38 connected to the diagonal strip 36 ; in the installed position both sleeves 38 are aligned with the openings 18 at the upper corners 13 of the support arm 12, 12_d to accommodate bolts or connecting elements along with the openings 12, 12_a.

In the case of the middle node 20_a in figures 6 and 7 the breadth b1 of side 32 is equal to approximately one third of the breadth b of the wall 24. Here, the integral diagonal strip 36 is situated directly in the corner 31_a ; the sleeves 38 for bolts are situated in corners 41 of an additional integral U-like frame bracket 40 of height h to the lower side 32_t of the frame. Both parallel side walls 42 of the U-like frame bracket 40 are integrally attached to its base strip 44 and are in line with the side wall strips 32 of the frame 30 and its edge – in figure 7 – front edge 46 is in line with the front edge 34. The breadth b_1 of the frame strip 32 corresponds approximately to double the breadth b_2 of the frame bracket 40.

Sub a2

The breadth b of the push-fit body 32_b in frame 30 in figures 8 and 9 is the same as its breadth b1; otherwise, this middle node 20_b is the same shape as the middle node 20 described above. Middle node 20_c (figures 10, 11) corresponds essentially to middle node 20_b in figures 8 and 9 with an additional frame bracket 40 in the design shown in figure 7.

Sub a3

Middle node 20_d in figures 12 to 14, of overall height i of approx. 115 mm and a transverse dimension e_1 of approx. 70 mm, exhibits a wall thickness t of 4 mm.

Both a corner 31_b of the frame 30 and the diagonal corner 41b of the frame bracket 40 form an angle w of 45°. The same holds for a corner region 23 of push-fit body 22_d. This is integrally formed on a diagonal strip 36 which here is continuous and makes an angle w_1 of 45° with the side wall 32. The overall length n of the middle node 20_d corresponds approximately with its side wall e of approx. 100 mm, the outer height a_1 of the push-fit body 22_a, here 55 mm, its breadth a_2 40 mm.

As illustrated in particular in figure 14, frame 30 projects on one side beyond the outer edge 46 of the frame bracket 40 – or beyond the planes E, E_1 defined by this – by a distance g of about 24 mm, and on the other side the push-fit body 22_d by a distance k of 36 mm.

The middle node 20_e shown in figures 15 to 17 corresponds approximately to middle node 20_d without frame bracket 40. The middle node 20_f, shown in figures 18 to 20, is approximately the same as the previously described middle node 20_e, whereby, however, the essentially rectangular push-fit body 22_f - as viewed in cross-section - does not project out, its breadth corresponds to the breadth b_1 of frame 30_a.

In figures 21 to 23 the frame bracket 40 is again integrally formed on the frame 30_a described in figs. 18 – 20, from which a part of the frame 30_a containing the push-fit body 22_a projects out a distance g.